EXAMPLE 4 ➤ Let f be the linear function $f(x) = 3x + 5$, and let g be the exponential function $g(x) = 2^x$, as in Example 3. Find these values.

a. $f(f(2))$

b. $f(g(f(-3)))$

SOLUTION **a.** $f(f(2)) = f(3 \cdot 2 + 5) = f(11) = 3 \cdot 11 + 5 = 38$

b. $f(g(f(-3))) = f(g(3 \cdot -3 + 5)) = f(g(-4)) = f(2^{-4}) = f(0.0625) = 3 \cdot 0.0625 + 5 = 5.1875$

Domain and Range of a Composite Function

In Example 2, you saw that the value of the inside function sometimes is not in the domain of the outside function. Example 5 shows you how to find the domain of a composite function and the corresponding range under this condition.

EXAMPLE 5 ➤ The left graph in Figure 1-4f shows function g with domain $2 \le x \le 7$, and the right graph shows function f with domain $1 \le x \le 5$.

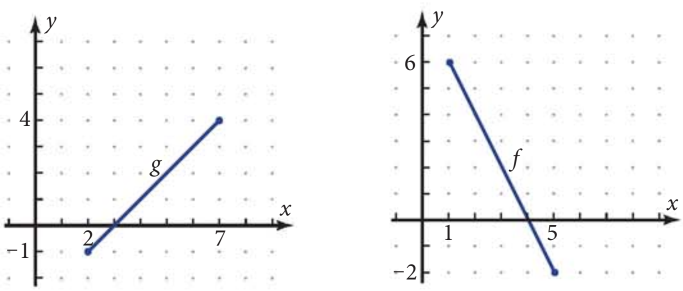

Figure 1-4f

a. Show on copies of these graphs what happens when you try to find $f(g(6))$, $f(g(8))$, and $f(g(2))$.

b. Make a table of values of $g(x)$ and $f(g(x))$ for integer values of x from 1 through 8. If there is no value, write "none." From the table, what does the domain of function $f \circ g$ seem to be?

c. The equations of functions g and f are

$$g(x) = x - 3, \text{ for } 2 \le x \le 7$$

$$f(x) = -2x + 8, \text{ for } 1 \le x \le 5$$

Plot $f(x)$, $g(x)$, and $f(g(x))$ on your grapher, with the grapher's grid showing. Does the domain of $f \circ g$ confirm what you found numerically in part b? What is the range of $f \circ g$?

d. Find the domain of $f \circ g$ algebraically and show that it agrees with part c.